Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

B. P. I.—441. Reissued December 13, 1909.
No. "A"—65.

United States Department of Agriculture,

BUREAU OF PLANT INDUSTRY,

Farmers' Cooperative Demonstration Work.

WASHINGTON, D. C.

COMMERCIAL FERTILIZERS: THEIR USES AND VALUE.

Since the prime object in the use of all commercial fertilizers is to increase production, they must be used either to supply plant food directly or to so act upon the soil that a larger quantity of its nutritive elements will be at the disposal of the plant. In actual practice most commercial fertilizers combine both effects. All the substances required by plants except three—nitrogen, phosphoric acid, and potash—are abundant in most soils.

The chief function of nitrogen in plants is to promote growth, but it is also of very great importance in the perfection of fruit. Nitrogen enters largely into the composition of plants, and it follows that everything of vegetable origin is a valuable source of this substance. When vegetable matter is burned, the nitrogen is released from its combination and escapes into the atmosphere and is lost.[a] The forms most important to the farmer of the South in which nitrogen is available are vegetable matter, the droppings of animals, cotton-seed meal, bone meal, nitrate of soda, sulphate of ammonia, and the products of the slaughter pen in what is known as tankage.

Next in importance as a plant food is phosphoric acid. It is largely required by the plant for growth, but is absolutely essential in the perfection of seed and is a great factor in hastening the maturity of crops. The form of phosphoric acid most accessible to the farmer is known as acid phosphate.

Potash is more directly effective in promoting fruitage, but it is rarely very deficient in soils, and especially in soils of the Gulf States. It is found in abundance in ashes. Commercially it is most cheaply obtained in the form of kainit.

WHAT FERTILIZER TO BUY.

Since the elements of plant food already mentioned are required in different quantities by different plants and since the soils vary in their supply, it is well for the farmer to know what his soil and plants need before investing his money in fertilizers. The practical way

---

[a] It is a bad practice to burn off fields and destroy vegetable matter; it is better to turn it under. The humus in vegetable matter has a value in soil renovation frequently greater than its value as a plant food.

for the farmer to determine these facts is to observe the growth of the plants on his land. If the plants grow rapidly and make an abundance of leaf and stalk, it is evidence of a good supply of nitrogen. If there is not a proportionate amount of fruit, it is a sure indication that the soil needs phosphoric acid. On the other hand, if the plant has not a good color and tends to drop its fruit before it reaches a fair size, it indicates that the soil requires potash.

Most of the soils of the South are deficient in both nitrogen and phosphoric acid, and some in potash. So when we buy commercial fertilizers we buy them for their content of these substances. If the farmer has saved all his manures and has grown cowpeas abundantly, as he should, he will rarely have to buy nitrogen.

HOW TO BUY FERTILIZER.

Commercial plant food, called "fertilizer," is never sold pure, but in combination with other substances. The substances with which it is combined are of no value to the farmer, but simply add to the weight. The laws of nearly all of the States now require that on each sack of commercial fertilizer shall be stamped just what plant food it contains. This composition is given in percentages, which means that in a hundred pounds of the fertilizer there are so many pounds of the particular substances. For example, a certain fertilizer is offered for sale on the sack of which is branded the following:

Nitrogen	3 per cent.
Soluble phosphoric acid	6 per cent.
Reverted phosphoric acid	4 per cent.
Available phosphoric acid	10 per cent.
Potash	2 per cent.

Translated into terms of pounds, this means that in a sack weighing 100 pounds there are—

Three pounds of nitrogen.
Six pounds of soluble phosphoric acid.
Four pounds of reverted phosphoric acid.
Ten pounds of available phosphoric acid.
Two pounds of potash.

This gives a total of 15 pounds of plant food in a 100-pound sack. When a ton of such fertilizer is bought, the purchaser secures nitrogen, 60 pounds; soluble phosphoric acid, 120 pounds; reverted phosphoric acid, 80 pounds; and potash, 40 pounds. Notice that what is called "available" is the sum of the soluble and the reverted acid. In this fertilizer we obtain three things that are of use—3 pounds of nitrogen, 10 pounds of phosphoric acid, and 2 pounds of potash to the hundred pounds.

If cotton-seed meal, acid phosphate, and kainit are used to make this fertilizer, it will require the following quantities for one ton of the mixture:

	Pounds.	Price per ton.	Cost.[a]
Cotton-seed meal	690	$25	$8.65
Acid phosphate (15 per cent available)	1,108	15	8.31
Kainit	202	12	1.21
Total	2,000	.....	18.17

[a] These prices are based on cotton-seed meal, at $25 per ton; acid phosphate, at $15; and kainit, at $12; if the price of these articles varies up or down, of course that of the ton of fertilizer will vary accordingly.

Ammonia is nothing but nitrogen in combination with another substance of no value. Inserting the ammonia in the formula is apt to deceive one who does not know the distinction. Remember that it is the pounds of plant food that are wanted, and not just a sack of stuff the majority of which is of no value.

Taking acid phosphates as an example, we find that there is a great variation in their composition. Some run as low as 10 pounds of available phosphoric acid to 100 pounds, while others contain as much as 14 to 15 pounds. As phosphoric acid generally sells at about 5 cents a pound, the former would be worth 50 cents a hundred, whereas the latter would cost 75 cents. In buying, then, it is economy to take the high-grade goods, even though they cost a little more.

An average sample of cotton-seed meal contains the following percentages of plant food:

Nitrogen	7.5 per cent.
Phosphoric acid	2.5 per cent.
Potash	1.5 per cent.

A 100-pound sack will therefore contain the following quantities of plant food:

Nitrogen	7.5 pounds.
Phosphoric acid	2.5 pounds.
Potash	1.5 pounds.

The phosphoric acid may be considered as available, as the fermentation renders it so.

HOW TO USE COMMERCIAL FERTILIZERS.

If fertilizers are used, the following general rule should govern: On rich lands use mainly fertilizers that will stimulate the fruit and not the stalk growth. On lighter lands use more of the elements to force growth, combined with others which will mature the fruit.

High-grade 14 per cent acid phosphate may be considered a basis for increasing fruit and hastening maturity of crops. Even on the richest land it has been demonstrated that a small percentage of nitrogen added to the acid phosphate gives better results. Use three parts of acid phosphate and one part of cotton-seed meal for cotton.

A mixture of one part of cotton-seed meal to two parts of high-grade acid phosphate will greatly increase the growing condition and will be better for medium soils.

Air-slaked lime is of value for use on stiff or gummy soils to loosen them up, permit the air to enter, and prevent a sour condition of such soils when too wet.

On thin or impoverished soils equal quantities of cotton-seed meal and acid phosphate can be used to advantage.

In case the foregoing can not be obtained, standard-grade commercial fertilizers may be used. These should contain in the mixture 8 to 10 per cent of available phosphoric acid, 2 to 3 per cent of nitrogen, and 1½ to 2 per cent of potash, or on some lands a high-grade acid phosphate, 14 per cent, may be used.

On black waxy land the best practice is to have the cotton follow a crop of cowpeas.

Where lands are greatly worn by years of cropping, more fertilizer should be used to the acre, and it should contain about equal parts of cotton-seed meal and high-grade acid phosphate. The beneficial effect of commercial fertilizers depends largely upon the presence of humus in the soil; hence the importance of using stable manure and plowing under green crops.

In applying the foregoing instructions the farmer must use considerable judgment and modify his practice where necessary to fit local conditions.

HOW TO APPLY THE FERTILIZER AFTER THE SOIL HAS BEEN THOROUGHLY PULVERIZED.

In the absence of a good machine, apply the fertilizer as follows:

Mark out the rows or bed-up, spacing as specified in the circular of this series containing general instructions (Circular No. "A"—69), and distribute the fertilizer in rows. Follow after with a bull-tongue or scooter shallowly to mix the fertilizer thoroughly with the soil.

Bedding-up land is a precaution against a heavy rainfall after planting. In sections where there is no danger from excessive moisture, flat planting is preferred, and in some cases it may be necessary to plant a few inches below the surface. Seeds must have moisture, but they must be kept out of standing water in the soil.

The fertilizer should be distributed several days before planting, as there is danger of injuring the seed if brought in immediate contact with strong fertilizer. A very careful mixing of the fertilizer with the soil is necessary for the same reason. On all except very rich waxy lands, it will pay to use commercial fertilizers somewhat liberally.

Where as much as 400 pounds of fertilizer is used for corn we recommend two applications, one in the furrow before planting and an application of from 150 to 200 pounds of cotton-seed meal in the furrow when the corn is about 1 foot high.

Where lime is used scatter it broadcast when the land is plowed, using about 4 barrels of air-slaked lime per acre, or apply in the row about 2 barrels per acre a short time before planting, mixing it thoroughly with the soil.

S. A. Knapp,
Special Agent in Charge.

Approved:
B. T. Galloway,
Chief of Bureau.

February 10, 1909.

O